



Aalborg Universitet

AALBORG UNIVERSITY
DENMARK

Percolative Inward Diffusion in Iron-Bearing Diopside Glass-Ceramics

Smedskjær, Morten Mattrup; Yue, Yuanzheng

Publication date:
2010

Document Version
Early version, also known as pre-print

[Link to publication from Aalborg University](#)

Citation for published version (APA):

Smedskjær, M. M., & Yue, Y. (2010). *Percolative Inward Diffusion in Iron-Bearing Diopside Glass-Ceramics*. Poster presented at International Congress on Glass 2010, Salvador, Brazil.

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal -

Take down policy

If you believe that this document breaches copyright please contact us at vbn@aub.aau.dk providing details, and we will remove access to the work immediately and investigate your claim.



INTERNATIONAL
CONGRESS ON GLASS
BAHIA - BRAZIL

GLASS • ENVIRONMENT AND SUSTAINABILITY



International
Commission
on Glass
(ICG)

ABIWIDRO

September 20 to 25 - 2010

PERCOLATIVE INWARD DIFFUSION IN IRON-BEARING DIOPSIDE GLASS-CERAMICS

Morten M. Smedskjaer*, Yuanzheng Yue

*Section of Chemistry, Aalborg University, Sohngaardsholmsvej 57, DK-9000 Aalborg, Denmark –
morten04@bio.aau.dk*

The so-called inward cationic diffusion is a diffusion process of network-modifying cations from the surface towards the interior of a glass. The diffusion occurs due to the reduction of polyvalent ions. In this work, we have shown that the inward diffusion degree of divalent cations decreases with increasing degree of crystallization in iron-containing diopside glass-ceramics, especially when the degree of crystallization is above 80 vol%. Below this critical degree of crystallization, the diffusion extent decreases only slightly with the degree of crystallization. No cationic diffusion is observed in the fully crystalline materials. The critical value might be attributed to a percolation transition from an interconnected to a disconnected glass phase. In earlier studies, we have shown that the inward diffusion approach can be used to create hard and durable surfaces on silicate glasses due to the formation of a SiO₂-rich surface layer. Therefore, the findings in this work might be used to design glass-ceramics with improved surface properties, i.e., by first making the glass crystallize to a degree below the critical value, and then making the inward diffusion occur via reduction of polyvalent ions.

Keywords: *Glass-ceramic; diffusion; diopside; percolation; surface modification; reduction*